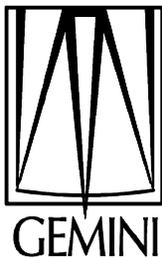


# **Conversion of the Gemini Control Systems to 3.13.4**

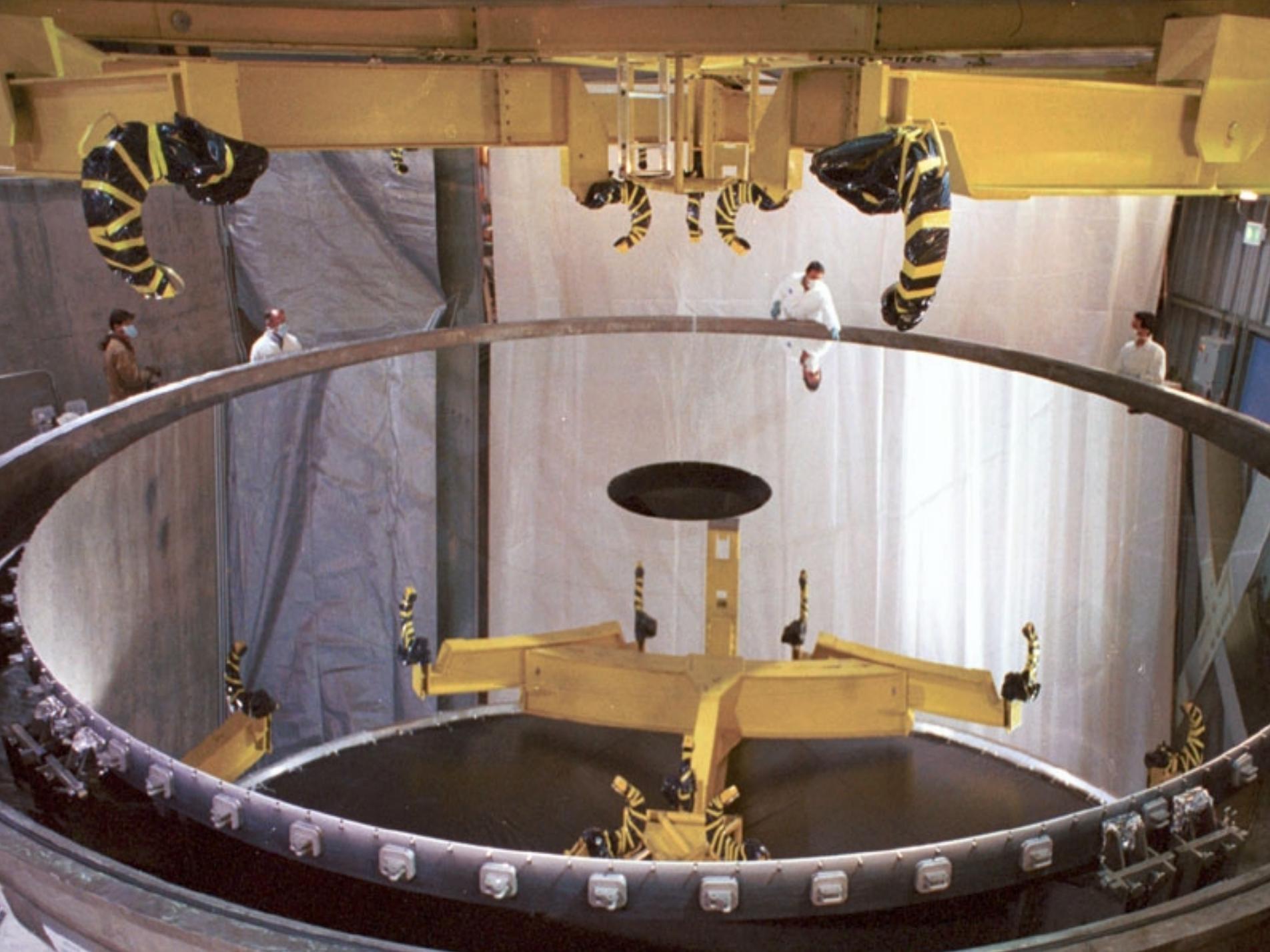
**Andy Foster**  
**Observatory Sciences Ltd**

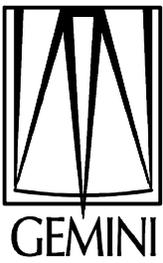


# What is Gemini ?

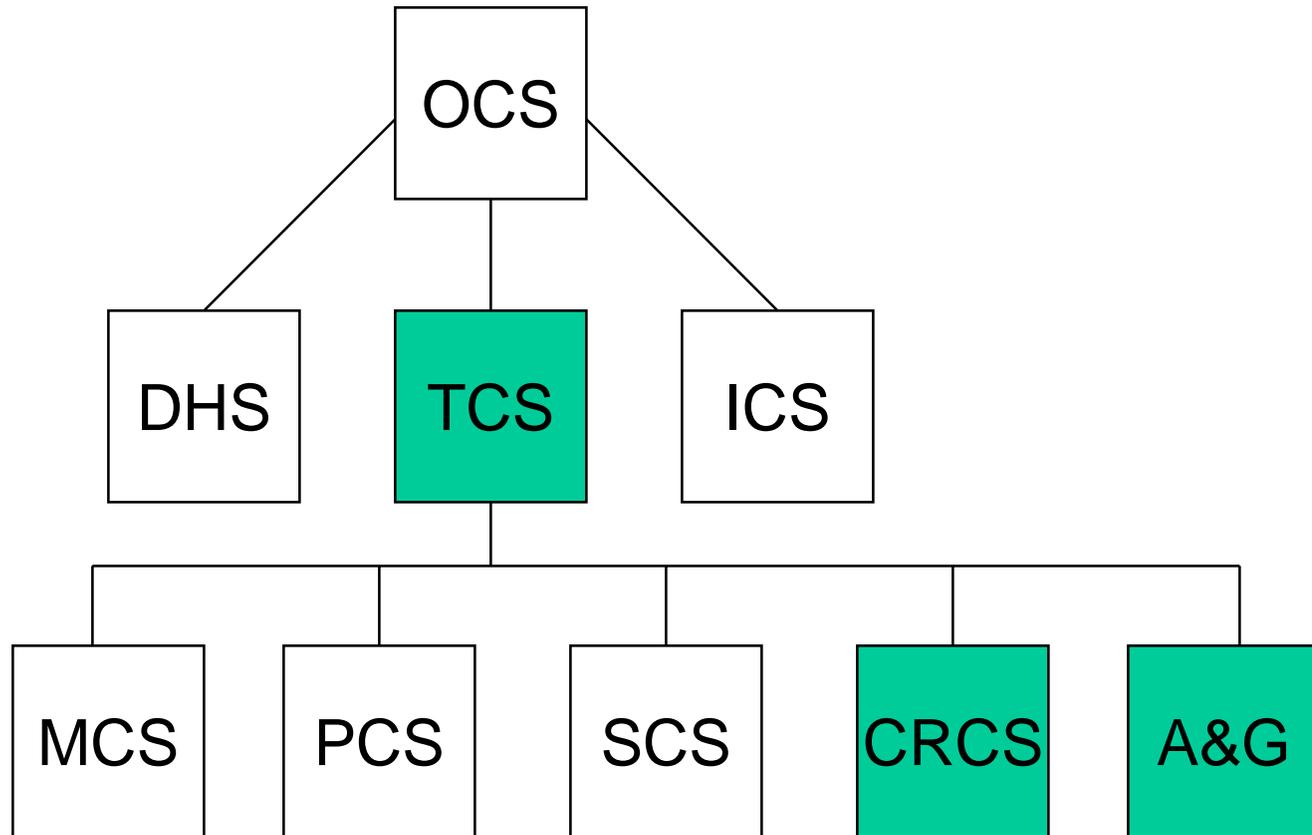


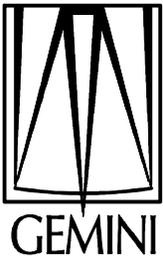
- **International Project**
  - USA (47.6%), UK (23.8%), Canada (14.3%), Chile (4.8%), Australia (4.8%), Brazil (2.4%) and Argentina (2.4%)
- **2x 8-m Optical/Infra Red Telescopes**
  - Mauna Kea, Hawaii
  - Cerro Pachon Chile





# The Gemini Control System

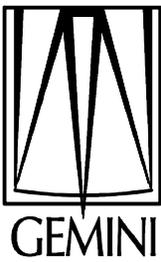




# Use of EPICS



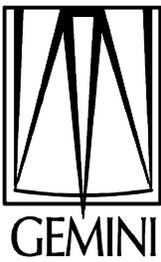
- **All telescope control**
  - Mount, Cassegrain rotator, Secondary mirror, Primary mirror, Enclosure , Acquisition and Guidance Unit etc.
  - 12 IOCs
- **All common user instruments**
  - Calibration unit
  - Multi-object Spectrometer
  - Near Infra Red Imager
  - 5 IOCs
- **1000 – 14000 records per system**



# Versions of EPICS



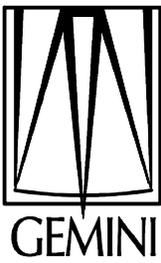
- **Addition of Gemini specific records and device/driver support creates a GEM release**
- **1995 GEM1 based on 3.12.2, vxWorks 5.1.1  
MVME167**
- **1998 GEM5, GEM6 3.12.2, vxWorks 5.2  
MVME167**
- **1999 GEM6T 3.12.2, Tornado 1.0.1, Power PC  
MVME167, MVME2700**



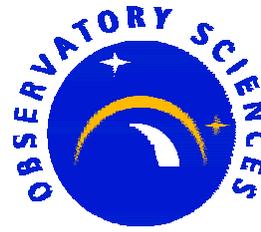
# Time to Upgrade



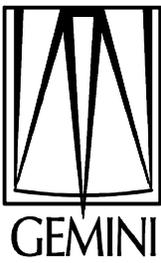
- **March 2001**
  - Start with the latest version of EPICS and vxWorks and produce GEM7
- **3.13.4**
  - Convert the Gemini records.
    - » CAD, CAR, APPLY    Command/Action Model
    - » SIR                    Gemini Status Record
    - » LUTIN                Lookup table conversion
    - » LUTOUT              Lookup table conversion
    - » GENSUB              General Subroutine Record
  - replace “ascii” with “dbd”
  - record changes (3.13 release notes)
- **Tornado 2.0**
  - Apply latest cumulative patch, T2CP4 -> Tornado 2.0.2



# Application Environment



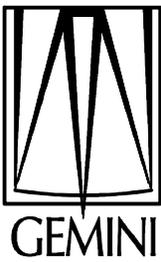
- **UAE (Universal Application Environment)**
  - From Nick Rees at JAC but add Gemini specifics
- **Changes from 3.12 version**
  - No soft links
  - Makefiles very different
  - applSetup now a Perl script (EPICS standard)



# Convert a system: the TCS



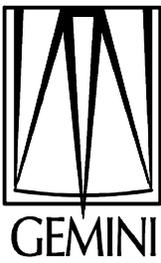
- **Controls no hardware directly**
  - Soft records
  - GEM7 deliberately does not include very much hardware support.
  - Took the view that each application would include only what it wanted
- **OSL primary responsible**
  - Easy for us to work on as only need a processor and a crate



# Converting the TCS



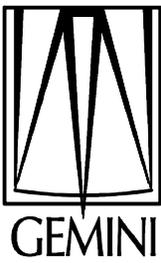
- **Build the system against original GEM release**
  - How many records?
- **Populate application with new Makefiles**
  - No more Makefile.Unix
- **Run a script in the source directory to convert old enumerated types to new ones**
  - 3.13 tools automatically create header files from menu descriptions. Make use of this.
- **Replace all “wait” records with “calcout”**
  - Never succeeded in getting “wait” to work
  - Really developed to support dynamic links in 3.12



# Converting the TCS contd.



- **Replace old redundant Gemini records**
  - mosub, was an early version of the genSub
  - subcad, 3.13 version of the cad includes all functionality
- **Significant changes in the startup scripts**
  - How EPICS is loaded i.e. just iocCore, seq
  - dbLoadDatabase not dbLoad “default.dctsd”
- **Load Tornado 2.0.2 on the IOC and try out the system**



# What happened?

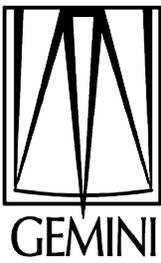
- Bug in the longout record.

```
if( plongout->omsl == CLOSED_LOOP )  
    status = dbGetLink(...);
```

- caused a random value to be placed in VAL when the record was being initialized from a constant link

```
if( (plongout->dol.type != CONSTANT) &&  
    (plongout->omsl == CLOSED_LOOP) )  
    status = dbGetLink(...);
```

- also seen in “dfanout”, “stepermotor” and “stringout”
- fixed in 3.13.5

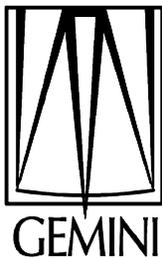


# Initialization problems

- Started with the existing set of Gemini record symbols.
- Needed to change this in the “stringin” symbol:  
**def(INP):000...0+00 -> def(INP):**
  - allows initial values of VAL to be set in the same way as in 3.12.
- Similar things for the “stringout” symbol and the “select” symbol

**def(DOL):000...0e+00 -> def(DOL):**

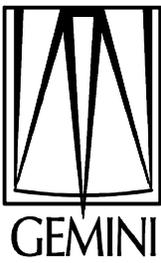
**def(INPx):000...0e+00 -> def(INPx):**



# Different colors on our screens



- **We traced this down to the wrong alarm severity in the record.**
- **Under 3.12, a record with a CA connection to a missing record had an Invalid Alarm severity**
- **Under 3.13, this is only true if the link property is set to “MS”**
- **Makes sense – but an interesting and very visual difference!**

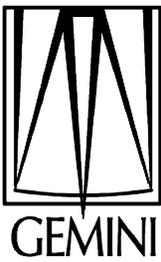


# vxWorks Statistics



- **A bug in devVXStats caused the PPC to crash**
  - Divide by Zero.
  - Not seen on the 68k as not trapped.
- **Marty produced a fix to the algorithm which calculates the CPU usage**
  - fixed in 3.13.5
- **Tried this and it worked well. The reported CPU appeared much more stable than previously.**

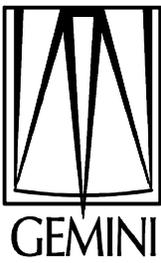




# Operational Test



- **First test failed because of a problem with double-to-string conversion.**
- **Problem was in “db/dbFastLinkConv.c”  
Routine “cvt\_f\_st”.**
- **Default precision in 3.12 had been set as 2.**
- **Default precision in 3.13 was 0. This caused us problems.**
- **We replaced this with 8 (maximum before the string format changes from a “%f” to a “%e”).  
– fixed in 3.13.5, default is 6**
- **16<sup>th</sup> June 2001 – Cerro Pachon, Chile.  
First working 3.13 system for Gemini!**



# Problems we have seen (1)

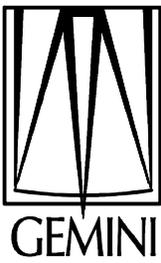


- **Some of these are probably due to the switch to Tornado 2.0**
- **Occasionally see this on the PPC console when shutting down “dm” screens:**

**0x33155a8 (CA\_client): memPartFree: invalid block xxx in partition yyy**

**Sometimes the CA\_client task is suspended afterwards.**

- **Have never seen it on a 68k.**



# Problems we have seen (2)



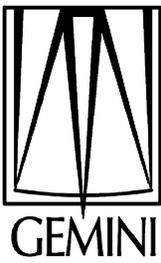
- We sometimes see these messages:

**CAC:error = "S\_errno\_ENOBUFS" sending UDP  
msg to x.x.x.x:5064**

**and**

**0x2ce2fb0 (CA\_online): ../online\_notify.c: CA  
beacon error was "S\_errno\_ENOBUFS"**

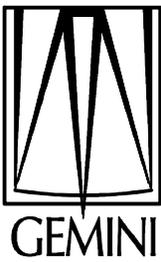
- **Lack of mbufs? I need to understand how to  
configure for more in Tornado 2.0**



# Problems we have seen (3)



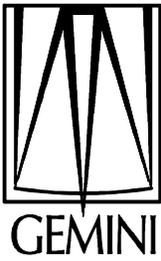
- **Just recently we had the situation where the “dbCaTask” was taking up 95-98% of the CPU.**
- **Rebooting had no effect**
  - System went straight back into a tight loop
- **Messages like these:**  
**dbCa: exceptionCallback stat Network Connection lost Channel unknown**
- **Suspect one of the TCS subsystems was having problems and so affecting the TCS?**



# Gemini Conversion Current Status



- **7 out of 12 telescope systems have been converted.**
  - Gemini Software team 3
  - OSL 4
  
- **4/5 instrument systems (North) on 3.13.4**
  - Gemini Software team 3
  - OSL 1



# EPICS 3.14



- **Why didn't we start with 3.14?**
  - Not ready for operations yet
- **Tried the 3.14alpha2 example on Solaris, 68k and PPC**
- **When compiled for the PPC with the “-g” flag, I had a couple of CA tasks crash at ioclnit.**
  - This did not happen when “-g” was not used?
- **Simple CA host program crashed under Solaris7.**
  - Noticed the release notes stated it had been tested under 2.6 and Solaris 8.
  - Or a compiler problem. We use gcc 2.95.3

